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ABSTRACT

The characteristics, advantages, limitations, and uses of the most commonly encountered instructional media are discussed. Guidelines are offered so that a training specialist can select the most appropriate visual material for group instruction. A checklist for evaluating instructional materials is provided. The media covered are projected media (slides, transparencies, filmstrips, television, etc.), real things, cutaways, models, and mock-ups. (JY)

Visual Materials:

Guidelines For Selection and Use In Training Situations

Training Systems and Technology Series: No. VI

U.S. CIVIL SERVICE COMMISSION

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Visual Materials: Guidelines for Selection and Use In Training Situations

DECEMBER 1971

U.S. Civil Service Commission
Bureau of Training
Office of Training Assistance

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INTRODUCTION

This paper, a part of the Training Systems and Technology Series, discusses the characteristics, advantages, limitations, and uses of the most commonly encountered instructional media. In addition, it offers guidelines that a training specialist can use when selecting visual materials for group instruction.

The technological advances in the last fifteen to twenty years have provided improved instructional materials for bringing the best, the most relevant, and the widest range of information to trainees. It has been shown that various media can improve learning and reduce instructional time in some situations. There is growing evidence that visual and/or educational media are proving to be more than "training aids." They have become essential to effective communication in group instruction; and in many independent-learning systems they are the only means of communication with the learner.

The term visual will be used throughout this paper to describe materials (software) that support instruction. In the educational community, "software" generally denotes those items that contain the message or learning symbols. Software such as charts, posters, etc. may be used in a training situation without the use of hardware (mechanical devices). Other items considered as "software," e.g. 35mm slides, overhead transparencies, video and/or audio tapes, etc., are often called media and they require the use of hardware.

SELECTING A VISUAL

As stated in the Report of the Commission on Instructional Technology, "Despite recent progress in educational research and development, educators still have few reliable, validated guidelines for choosing one instructional medium over another." [1] Therefore, it should be recognized that an instructor has to work within limitations as he selects the most appropriate available resource—one that has high probability of assisting a trainee toward objective achievement.

Selecting an appropriate and effective visual is no easy job. Many instructors have treated their visuals so casually that they have ignored the possibility that there may be better ones available. Whenever new material is taught, new visual materials must be brought into the classroom to support it. Even a slight change in the objective of an existing lesson may render an otherwise effective visual useless. To meet the requirements of changing lessons and lesson objectives, instructors must constantly reevaluate their visual materials. Certain key factors, however, should always be observed when replacing a visual or designing a new one.

Determine Need

The first, and probably the most important consideration is need. Whenever there are teaching points which are difficult to explain, a visual may be needed. If oral description fails to convey a clear and complete image to the trainee's mind, a visual may be needed. This criterion of need should be applied not only to new lessons, but to older established lessons in the program of instruction.

Visuals also may be used to motivate interest at appropriate points in the development of a lesson. However, any visual the instructor chooses to "perk up" his lesson must be related to the material he is teaching. If the visual contains an emotion laden concept, or an idea that causes the trainees to want to pursue the concept portrayed, the visual ceases to function.

See footnotes at end.

Facts Required

When an instructor has decided a visual is necessary, he must next determine what the visual has to do. That is, what must the visual accomplish in terms of the lesson objective and what image should it establish in the trainees' minds.

1. Lesson objective. The lesson objective determines the level at which trainees are being taught. Given in terms of familiarization, working knowledge, or qualified knowledge, this objective helps determine the type and nature of the visuals that will be necessary for the lesson. Familiarization is the level at which "trainees learn sufficient facts and principles to be able to recognize their importance and know where to go for additional knowledge should the need arise." [2] At this level of instruction, the clarity and simplicity of graphic visuals often provide the necessary impact and stimulate appropriate recall more conveniently and inexpensively than other visuals. Furthermore, the instructor will find that graphic visuals satisfy trainee's curiosity as well as develop their interest in subsequent lessons.

To support the achievement of higher learning levels, more involved, detailed, and complex visual materials are often necessary. To develop a "working knowledge, trainees must possess a sufficient knowledge of related facts, principles, and techniques to enable them to perform routine practical applications under direct supervision of a qualified individual." [3] When instruction is given at the working knowledge level, visual content should include additional facts which will build on conceptuals gained during familiarization. To develop qualified knowledge, "trainees must be capable of demonstrating sufficient knowledge to permit independent functioning in the area concerned." [4] When instruction is given at this level, either actual equipment or suitable substitutes should be

available for maximum realism. Since models etc. are often very complicated and expensive, a professional media specialist should be consulted regarding its use and handling.

2. Clear image. A distinct mental image of the visual must be established before an instructor can hope to have it reproduced. It must be the exact image he intends to transfer to his trainees. What is the *right* image? Simply, the one that is essential, exact, and basic. Frequently, experts in subject knowledge overlook fundamental points that are essential to trainee understanding. Consequently, they select too complicated a visual for the beginning trainee. Two simple visuals, used in sequence, are preferrable to one complicated visual. (In the next section, we will discuss design characteristics).
3. Evaluate. Whether or not a visual will accomplish its purpose can be judged at two points: during the dry-run and in the actual classroom setting (Evaluation of visual materials is discussed in a later section of this paper: "Follow-up Evaluation"). The instructor should dry-run his visual with his lesson materials to determine the appropriateness of the visual for himself. If he rehearses before other staff members, they, too, can help him with their comments and reactions. Having satisfied himself that the visual works in the dry-run, he can then use it in the lesson. Again, evaluation should be made. If the instructor senses that the trainees did not respond as anticipated, he must re-examine his visual. A few inquiries among members of the class may suggest corrections or changes that should be made.

DESIGN CHARACTERISTICS

That visuals function in the ways described above does not happen accidentally. Correct design (or careful selection) and professional handling all contribute to the effectiveness of a visual. First, there are seven physical characteristics which must be "built-in" into any visual if it is expected to perform its intended tasks. These charactertitics are: [5]

Legibility

A visual has to be legible. It must permit itself to be seen, deciphered, and understood by the viewer. Legibility involves overall design, size of lettering (2" minimum for use in a 60' classroom), and strong sharp contrast. Clarity of detail, and qualities of accuracy and realism should also be considered. Two questions should come to mind whenever designing a visual. "Can it be seen from the back of the room?" "Is its message still clear?"

Simplicity

If a visual is simple, it appeals to a broader audience. If it is complicated, it meets with varying degrees of resistance. This is true of both verbal and purely pictorial visuals. Verbal visuals include words written out on slides or charts or the chalkboard. Often an instructor tries to put too much information on a single slide or chart. The result: confusion. The problem is more pronounced in pictorial visuals. For example, if the students are being introduced to certain components of a tractor-grader these components should be highlighted in relation to the rest of the machine. All too often, however, the instructor has on overhead slide of the tractor-grader that omits any distinction between the components he wants his trainees to recognize and identify, and the rest of the equipment. Instructors should be aware of the relevant examples and guard against injecting non-essentials into their visuals which may distract the trainee and lessen the effectiveness of the visuals.

Accuracy

The difference between accuracy and realism is not always distinct. Generally, however, accuracy means precision. If a visual is to be accurate, specific facts, statistics, specifications, scales, or formulas (if involved) must be included. If a visual is designed to

scale, it must be designed to scale throughout. A demonstration slide rule is an excellent example of an accurate visual. Yes, it is many times larger than an actual rule for use, but it has been uniformly increased in size. And to be effective, we need more than just a working model with a movable slide or hairline. The demonstration slide rule must first of all be a slide rule, complete with accurately printed logarithmic scales so the instructor can work problems along with his trainees and come up with the correct answers.

Where ideas and not definite facts are involved in an explanation, accuracy is not absolutely necessary. Therefore, accuracy serves only to enhance the explanation and add to the visual's realism.

Realism

While both accuracy and realism will strengthen the effectiveness of a visual, accuracy is not needed to present a realistic image. That "having been there" feeling aroused by a realistic visual creates a strong impression on the trainee; he actually becomes emotionally involved with what he is learning. To accomplish this, both the instructor and the fabricator of the visual must work together in pursuing the appropriate design, necessary details, and type of visual to be employed. Adaptation of photographs taken on site, artists' renderings of verbal descriptions given by participants, even outmoded equipment that employs the basic components of newer designs can be used as dramatic, realistic visuals. At times, dramatized presentations and demonstrations are used because they allow the viewer to emphasize and project himself into the action.

Colorfulness

Color is an integral part of vision, and nothing is more natural than exploiting a trainee's sense of color to help him learn. Visuals can be made more realistic if they are properly colored. A predominant color helps focus attention. For example, the spacing bar on a typewriter could be highlighted with a circle of red on an otherwise all black and white photo. Colorful displays, exhibits or dramatizations all have more emotional appeal than their pale black and white counterparts.

Of course, there can be too much color. Since color affects the relative importance of items, overcoloring produces confusion. An instructor should always study his needs with reference to the effect color or color combinations will have on the viewer. He should design his visuals accordingly. Best results are usually obtained by referring the problem to a professional artist.

Durability

Obviously, a visual should last a reasonable length of time. This is important in view of the fact that considerable time and labor are involved in producing a visual, making them much more expensive than they would first appear. Their value in instruction, however, often justifies such expenditures—providing the visual lasts a reasonable length of time. Special materials or treatments can be used by the fabricator to prolong the life of a visual.

But while a visual should last a reasonable time, it also should not be expected to continue in use indefinitely. Most two-dimensional visuals are relatively sturdy and replacing them is comparatively inexpensive. Models require much more care and maintenance since they are both more delicate and more expensive, and replacements may not be readily available. Models and mock-ups used outside should be coated with an exterior finish.

Manageability

No instructor would want to devise a visual which is too large or too awkward to handle. Occasionally a full-size model or an over-size reproduction is needed, but smaller substitutes will usually serve the instructor's purpose. If large visuals *are* definitely needed or an unwieldly visual must be used, the instructor should re-examine his goals, his visuals, and his facilities. Relocating instructional space, for example, might solve the problem. Or, if his trainees are ready for direct contact with the material, the instructor can substitute the actual equipment for his former visual. Where site changes are not advisable, models, mock-ups, and other types of relatively small-scale objects can often produce adequate visual impressions on the viewers.

TECHNIQUES IN THE USE OF VISUALS

Visuals must be used proficiently if they are expected to function effectively. There are many acceptable ways of using visuals for maximum effectiveness which will be discussed in the following pages. If the visuals are not used in the proper sequence, or exposed to the class at the proper time, they will detract from the presentation.

Prepare for Use of the Visual

Systematic planning for instruction will require a suitable environment and necessary equipment in addition to appropriate materials. An instructor will become frustrated after planning to use specific instructional materials if he discovers that a classroom cannot be darkened for projection or that the message content is illegible to the trainees seated in the rear of the room.

Just as a lesson plan is organized into a logical sequence, so should visuals be coherently arranged. A random irregular presentation of visual material is equal to a rambling presentation. Therefore, the use of the visual should be rehearsed several times. This will permit the instructor to become fully familiar with the sequence of the visuals and their content, and can check on the adequacy of the visual in the actual training room setting.

Explain Message to Class

Elaborate visuals are often used to illustrate complicated or technical subjects. Before showing this kind of visual, the instructor should briefly explain its purpose and function. Otherwise, the trainees will be distracted by all the details of the visual and miss part of the oral presentation.

Display at Appropriate Time

Visuals should be covered or out of view when not in use to avoid attracting unnecessary attention. If a chart contains lines of printing, strips of paper can be cut to cover each line and removed one by one at the appropriate time. Models and cutaways can be covered with cloth.

Use a Pointer

A pointer is useful in focusing the trainee's attention on a particular part of a visual. It should be held steadily on the part of the visual that the class is expected to observe. It should be held in the hand nearest the visual in order to maintain better eye contact with the class. If the pointer is held across the body, the instructor is likely to speak to the visual rather than to the students. To prevent distracting mannerisms, the pointer should be set aside when it is not needed.

Use Assistants to Best Advantage

If assistant instructors are used to handle or operate the visuals, they should be well-rehearsed so they will know exactly what to do and when to do it. If an assistant is projecting visuals, a prearranged signal will alert him to the exact time to change the slides or turn off the projector.

Display Visuals Smoothly

When using several visuals, number the visuals in the order in which they are to be used. If possible, it is best to have the equipment moved into the classroom before the class begins. If not, it should be moved in quietly to prevent disturbance.

FUNCTIONS OF MEDIA

Good instructors use media because they recognize that aural communication, even at its best, is often inadequate. A classroom instructor who attempts to transfer his knowledge to the trainee must convert his ideas into words which he audibly presents for the trainee to decode and convert back into meaningful ideas. The following example illustrates the difficulty which even the simplest verbal explanation presents. If an instructor describes aurally the design of the stairway leading to the top of a lighthouse to a group of trainees who have never seen one, he might describe it as a spiral or (by analogy), like a corkscrew or bedspring. Regardless of his care in describing the staircase, there will be little un-

iformity in the way the trainees interpret his description. Had the instructor displayed a graphic visual (i.e. a photograph, accurate drawing, or a projected item), the trainees would have received the intended concept more quickly and more accurately.[6]

When information is difficult to explain verbally, when specific procedures must be performed, if exact interpretation of information is necessary, good visuals can not only (1) illustrate the instructor's concept to the trainee but (2) add emphasis to essential points.

PROJECTION MEDIA

Probably the most difficult task for the classroom instructor is to gain the attention of the learner. Projection media are a powerful means of gaining and holding attention. The major force which attracts the learner's attention when using projection devices is the concentration of focused light on the screen surface.* Paralleling this is the impact of the images which represent the teaching point.

Many types of projection media are available, each having advantages and limitations. Each type of projected visual require a specific projection device, consequently each type will be discussed separately. At the end of this section (Figure 8) a comparison of capabilities for each medium include: (1) image quality, (2) hardware and, (3) software. The ratings (E-Excellent; VG-Very Good, F-Fair, and P-Poor) are based on maximal qualities each item is capable of providing.

35mm Slides

The 35mm slide is a transparent picture or image, individually mounted in a 2" x 2" frame, which is projected by passing a strong light through it. It is compact in size, convenient to manage, and renders a clearly detailed image. Message content can be brought up-to-date by replacing the individual slide with a new one. Additional slides can be inserted for appropriate teaching points after initially prepared slides have been sequenced in the program.

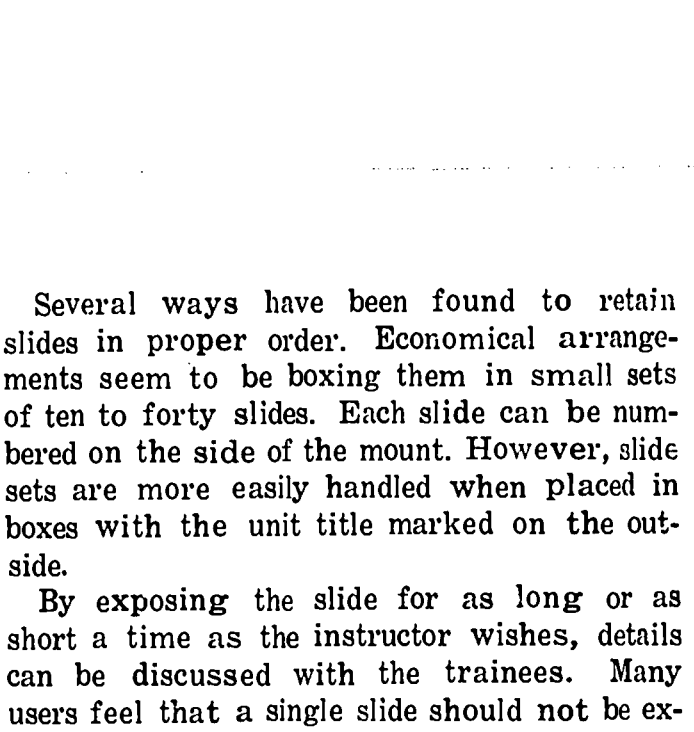
* Factors affecting the brillance of the screen image are (1) the projector's light intensity; (2) the distance of the projector from the screen; (3) the size of the screen image; (4) the reflecting quality of the screen; and (5) light interference.

Several ways have been found to retain slides in proper order. Economical arrangements seem to be boxing them in small sets of ten to forty slides. Each slide can be numbered on the side of the mount. However, slide sets are more easily handled when placed in boxes with the unit title marked on the outside.

By exposing the slide for as long or as short a time as the instructor wishes, details can be discussed with the trainees. Many users feel that a single slide should not be exposed to the audience for more than 1½ minutes. If a longer period is needed, additional slides should be added, thus giving variety to the showing.

The necessary projection equipment is simple to use. Skills required to operate the equipment can be learned in minutes. Modern automatic 2 x 2 inch slide projectors utilize "trays" that serve both as storage compartments and as part of the slide feed mechanism. Fully automatic projectors also change slides at predetermined rates, while others operate by remote or manual control.

Figure 1
35mm SLIDE



Lantern Slides

The "lantern slide" is an individually mounted transparent picture or image, enclosed in glass, which is projected by passing a strong

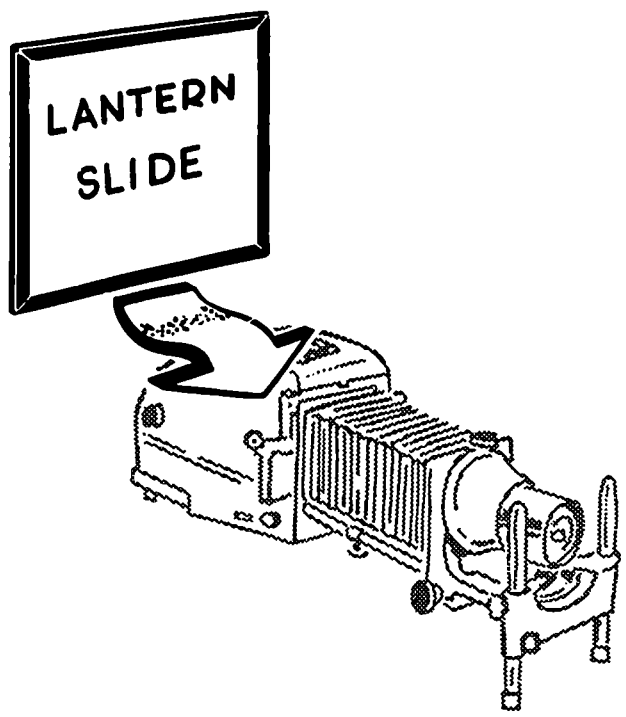
light through it. The glass mounting provides good protection against fingerprints and damage to the surface, but the slide is heavy and bulky with a high breakage factor.

Its use is less common today, but is still used occasionally in specialized fields, such as medicine and art. More detailed images can be projected without loss of definition through diffusion, since the slide is 3¼" x 4" in size (5½ times as large as the 2" x 2" slide). The lantern slide can be fabricated commercially or handmade by the instructor on etched glass, translucent plastic, cellophane or clear glass.

These slides are used primarily with front-view projection. Therefore, the brilliance of the projected image will not only depend upon the quality of the transparency, but also upon a darkened room.

The lantern slide projector is simple to operate, but usually requires focus adjustment each time a new slide is projected. The unit must be operated manually, requiring the instructor or an assistant to remain at the projector.

Figure 2
LANTERN SLIDE



Overhead Transparencies

The overhead transparency is made of plastic, cellophane or acetate sheets with a size up to 10" x 10". Tracing, drawing, writing, and photographic reproductions made on these sheets can be projected clearly on the screen. The image will have equal brilliance on front or rear-screen projection. With the strong light of the overhead projector, transparencies can be used in an area where blackout is impossible.

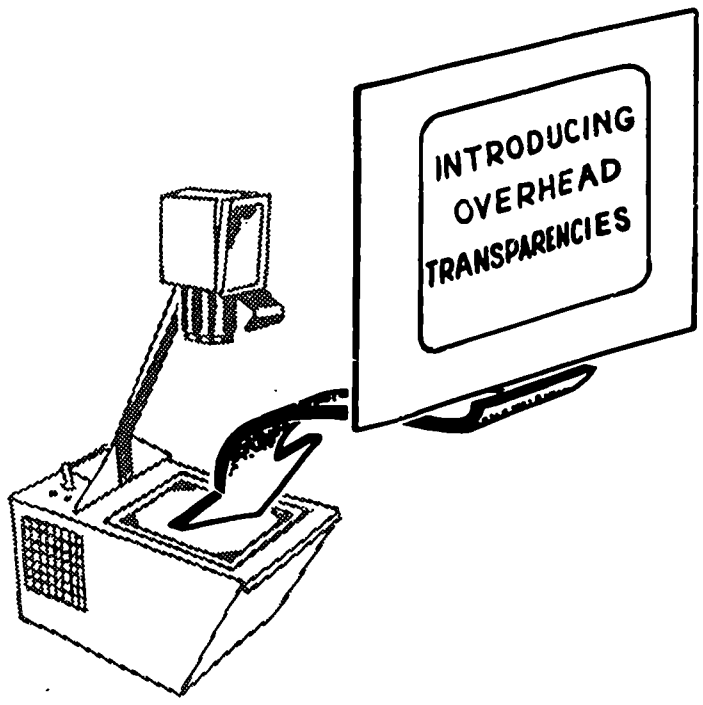
Additional transparency sheets (overlays) can be superimposed and attached to the frame of the base transparency. By using overlays, the instructor can separate processes and complex ideas into elements and present them in step-by-step order. Also, a felt point pen or wax-based pencil can be used to add points to the transparency during the presentation. If water-based pens are used, the marks can be removed with a soft, damp cloth.

Many commercially prepared transparencies are of excellent quality, but some are not. In many cases, they may be well designed and appropriately colored, but their letters are too small to project a legible image. Also, the message may not be designed to specifically support or clarify the teaching point in any particular lesson. Often the message will include unnecessary material which can be distracting to trainees. It is the instructor's responsibility to consider the following criteria when recommending the purchase of prepared transparencies[7] (use the same criteria for transparencies created by an instructor):

—Does the subject lend itself to the transparency form (as opposed to a poster, chart, mounted picture, slide, filmstrip, or other medium)?
—Is the content accurate and up-to-date?
—Does it make good use of transparency techniques (overlays, or other features)?
—Does it meet minimum letter size and color quality?
—Will it encourage trainee participation through the use of relevant questions?

The overhead projector is manually operated for both front and rear-view screen utilization. Should a projectionist or assistant instructor be used to operate the device, he should know when to change the items to reduce the errors of rough handling to a minimum. (If the projector is operated by the instructor, he should practice using the transparencies prior to the live presentation for smoothness of utilization.)

Figure 3
OVERHEAD TRANSPARENCY



Polarized

Polarized items can simulate motion. This illusion is created by projecting light through a rotating polarized filter (spinner) on a surface or through a transparency on which polarized acetate is attached.

Polarized charts are made by gluing polarized acetate to a rigid surface. These items can be considered when room darkness cannot be attained in the classroom. However, they require more storage space and are more difficult to maintain than the polarized transparencies.

Polarized items are generally considered when (1) the subject content requires a design to depict the flow of blood through arteries, (2) normally required learning time for complex systems can be reduced.

Under controlled lighting conditions, the overhead transparency is the better item, since the cost of fabrication and maintenance are less. Transparencies having this treatment adhered to their surface produce a simulated motion when light passes through the acetate (treatment) and rotating spinner simultaneously.

Transparencies (35mm and overhead) can be prepared commercially using a photographic process to apply treatment, but the cost is greater than that of the manual application of the polarized acetate.

When polarized transparencies are used to simulate motion, the projected light on the screen is reduced approximately 35%. Additionally, 35mm slides are not recommended for this method of producing motion due to the limited detail that can be included.

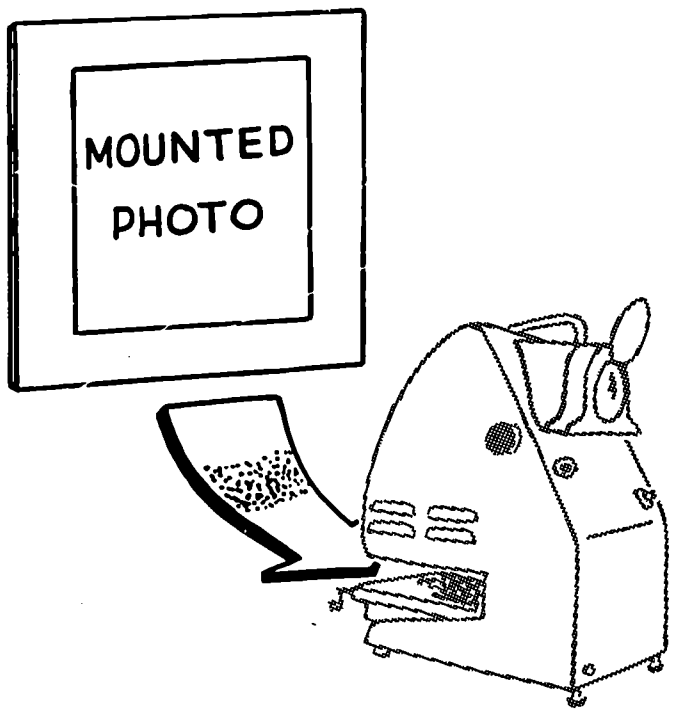
Opaque

The opaque projector reflects light from the surface of the visual to the screen. Consequently, the projected image is less bright and often unfavorable when compared to direct light projection. It will project any type of printed matter (color and black and white) and some three-dimension objects as well.

Instructors often consider using the opaque projector to show trainees items contained in a book, newspaper, or magazine which require a copyright release before reproducing into a transparency. Also, enlargements of drawings can be sketched on a chalkboard prior to classroom instruction by projecting the image and outlining desired components. This permits the instructor to develop the teaching point(s) by drawing vividly each component outlined as he progresses in the lesson.

Newer projectors are less bulky to handle

Figure 4
OPAQUE



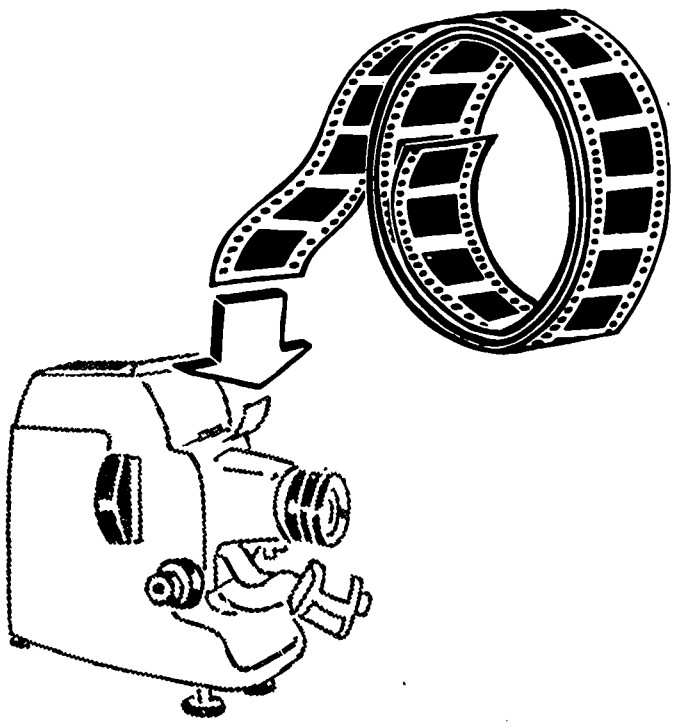
and provide more light than did those of a few years ago. Nevertheless, a well-darkened room is required to get viewable results. Both new and old opaque projectors contain a projection lamp which generates considerable heat. Paper exposed more than six minutes may char or even burn. Some types of plastic may soften when exposed to the heat for an extended period of time.

Filmstrips

These consist of a series of 35mm single frames processed into a single strip. The filmstrip, wound into a roll and stored in a can approximately 1 inch in diameter, can be equivalent to numerous charts, pictures and drawings. Since each frame remains in the same sequence, instructors should consider using filmstrips when the subject matter is of a relatively constant nature for an extended period of time.

The cost of making a filmstrip is relatively small. But if a single frame in the sequence becomes obsolete, the cost to replace the filmstrip, omitting the obsolete frame, would be greater than replacing individual transparencies of equal projection image quality.

Figure 5
FILMSTRIP



Multi-Media

The multi-media approach is a combination of instructional materials used in a learning situation. These materials (often called instructional kits or learning packages) may include written, pictorial, and audio media for maximum learning imput. The combinations are of course limitless, depending on many factors, some personal, some physical in terms of training facilities and services.

Audiovisual equipment has been developed by manufacturers to facilitate the use of multi-media programs. Some equipment contains a system to record student responses, and combine automated and manually controlled operations in presenting sound or silent filmstrips, motion pictures, slides, taped narrations, and quizzes. "Such equipment is capable of easily moving from one medium to another, stopping for work assignments or personalized instructions and elaborations, start up again, and register and tally individual student reactions and responses." Figure 6 illustrates a multi-media system developed especially to present material, test for learning, and record student results.[8]

For example to help trainees become more active in the learning process, a multi-media laboratory can be erected for personnel interviewing and counseling. Formal presentations are recorded on tape, slides, and films are produced, and programmed work sheets accompany the taped lectures. Trainees can go to the laboratory at scheduled times and work at individual carrels, each having a tape player and the necessary viewing equipment.

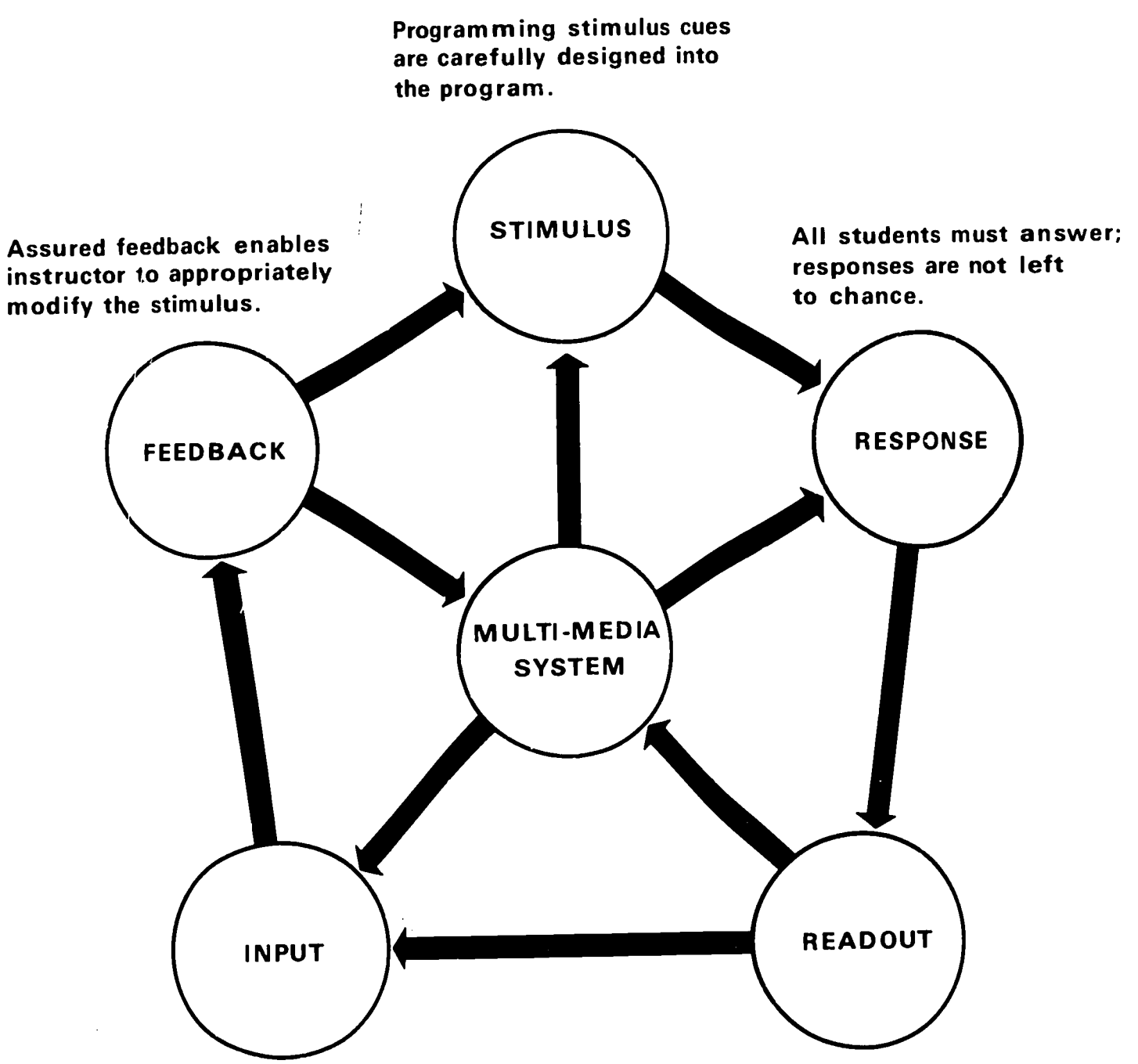
TV and Motion Pictures

TV and motion pictures are often discussed separately, but there is no important reason for doing so. They both perform the same function. Each can display events or a sequence of events, such as interviewing procedures used by a personnel classifier. They can often replace a demonstration which may require expensive equipment. According to Gagne', "Moving pictures is a good general name for the combined instructional medium they represent."[9]

"Moving pictures" should be considered when motion is needed to show relationships of one idea to another, to build a continuity of

Figure 6

INSTRUCTIONAL CYCLE



thought, or to create a dramatic impact.

Circumstances often lead to the selection of television or a motion picture. One may be to make the invisible visible. For example, if a learning objective requires the student to identify the steps of pollination, it would seem desirable to use an animated film clip to show how pollen develops on the surface of the anthers, drops on the sticky end of the pistil, transmits germ material to the ovaries, and combines in developing seeds. Television or motion picture could realistically demonstrate this process.[10]

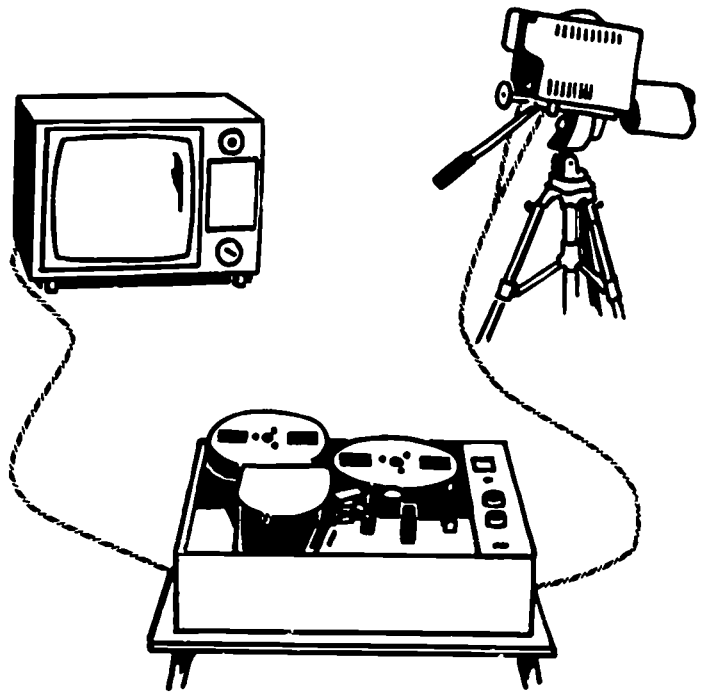
Additionally, three-dimensional characteristics can be portrayed quite readily via television or motion pictures rather than a mock-up or model. If the instructor wants to show his trainees a specific angularity which characterizes a piece of glass tubing, he can use a motion picture or television in which the tubing is turned in various directions as it is photographed. Thus the trainees can learn to identify certain three-dimensional characteristics from a two-dimensional medium.

Another reason to select television or a motion picture may be to compress time. Varying the ratio between the intervals of recording frames in film and television and that of projection, motion can be made to apparently speed up or slow down. Again, a film clip, through time-lapse photography, would actually relate the development of the flower from bud to mature seed. This process can be shown in a short period of time.[11]

Due to the pace, unity and fact density of motion pictures and television, the instructor has limited influence on students during the presentation. His influence is largely confined to what happens before and after the presentation. He can tell his students what to expect and he can help them recall and organize what they saw and heard, but he cannot speed up or slow down the rate of presentation. He cannot explain, enlarge, clarify, or correct during the presentation.[12]

The videotape system (camera, recorder and television monitor) has the capability of "instant replay" which can be controlled by the instructor and used for analysis of performance. It is easy to see the impact of the medium when videotape is used to critique a lesson taught by a novice instructor.

Figure 7
VIDEOTAPE SYSTEM



A more thorough treatment of the television medium is provided in another Training Systems and Technology publication titled "Application of Television in Federal Training Activities."

Front vs Rear Projection

Two different methods may be used for projecting images onto a screen. The choice of method will influence the projection system and mode of instruction. The first method, front projection, permits both the projector and the viewers to be on the opposite sides of a translucent screen through which the image is displayed. Both front and rear projection have advantages and limitations.

Rear projection requires less control of ambient light in the classroom. This is an advantage where interplay between instructor and trainees is desired. In addition, rear projection prevents light path obstruction by either the instructor or the viewers. The instructor can stand in front of the image to point out details without casting distracting shadows.

Rear projection requires additional space behind the screen so that the projectors can cast an image far enough so that it will be legible. Combinations of mirrors or short focal-length lenses can be used to offset the need for a large

Figure 8

COMPARISON OF IMAGE, HARDWARE, AND SOFTWARE QUALITIES

	IMAGE QUALITY			HARDWARE					SOFTWARE		
	COLOR	BRILLIANCE	*	EASE OF OPERATION	PORTABILITY	REAR VIEW	FRONT VIEW		PORTABILITY	DURABILITY	EASE OF PRODUCTION
35mm	VG	VG		VG	E	VG	E		E	VG	E
3¼ x 4	VG	VG		VG	VG	*	E		E	VG	E
OVERHEAD	E	E		E	F	E	E		E	VG	E
POLARIZED											
(Overhead)	F	F		VG	F	E	E		E	F	VG
(35 mm)	P	P		P	VG	F	F		E	F	P
FILMSTRIP	VG	VG		VG	E	VG	E		E	VG	VG
FILM	VG	VG		VG	F	E	E		E	VG	F
OPAQUE	F	P		F	F	P	P		* *		

** Generally impractical because the large size of this slide makes it ideal to use in an auditorium or other large space where it is necessary to have a large bright image on the screen.*

***(1) Printed items should be mounted on a stiff backing; (2) Maximum height of three-dimensional items can be 1¼" inches.*

amount of space. However, the short focal-length lenses of mirrors may result in an inferior projected image. These conditions may also decrease the optimum viewing distance in the classroom.

When using front projection, the permanent screen should be mounted above the height of the average instructor to prevent obstruction of the projection beam. The screen should be angled and the projector tilted so the face of the projector head and screen surface are perpendicular. This type of projector and screen placement will produce a square projected image and prevent a keystone effect.

Real Things

Real things are objects, specimens, remains, evidence, artifacts, and people.[13] In many learning situations, no better teaching device exists than a face-to-face meeting with the people or objects being discussed or studied.

The objective, to name the 12 plants and animals found in a marsh, given examples of each, can best be attained while on a field trip where actual objects can be observed in their natural setting. But suppose the class is taught in a location where transportation is difficult and expensive to arrange. Real things might still be used if plants or animals could be brought to the classroom. Preserved plants and animals or models of plants and animals might be used.

The more closely a learning experience approximates the actual job conditions under which the trainee will perform at a later time, the more effective and permanent learning will be.

There are occasions, of course, when real things either are not available or are so large, so rare, or so difficult to obtain that they cannot be brought to the trainee. Often, real things are so small that the instructor cannot use them effectively for group instruction. However, the outline of a small item can be projected on an overhead projector. Such media as pictures, films, videotapes, slides and models, must be used when real things are not practical. Even when such media are used to increase the size of detail, some real items could be briefly shown to the trainees, then put aside for individual review. No matter how well made the replica of an item may be, a reproduction does not have quite the vividness of appeal as the thing itself.

Cutaways

A particularly effective three-dimensional teaching device is the cutaway. Here, components of the real thing are literally "cut away" and an item opened up so that interior portions can be seen clearly. Cutaway items are useful in teaching processes, operations, or displaying inner parts of an item. For example, in teaching the operation of the automobile clutch, gasoline or turbine engine, cutaways are valuable; for they enable both instructor and trainees to look at components normally hidden by the metal cover. Internal parts are frequently color coded to aid both trainees and instructor in identifying the different parts.

As a result of increased labor costs, projection materials of the real items cut away have often replaced cutaway models. Often, the item itself can be cut away, exposing necessary internal parts, photographed and processed into a transparency.

Models

A model is a recognizable imitation of the real thing (probably made of plastic, wood or metal). It may be workable and identical in every respect with the original except size. The purpose of fabricating a model may be to increase or reduce the real thing to a manageable size.

Models bring increased reality to any learning situation and serve as a means to provide vicarious experiences in terms of learning to recognize and identify things.

In making scale models, the craftsman can rearrange or construct individual parts to show relationships to a whole. For example, the model of a tractor or human heart can be presented so that individual parts are clearly seen. The fact that such models can be made larger or smaller than life size provides both instructor and learner with materials they can handle and use.

Models may be used in conjunction with other media. To teach trainees how to multiply with a slide rule using the "C" and "D" scales, what are the media alternatives? This

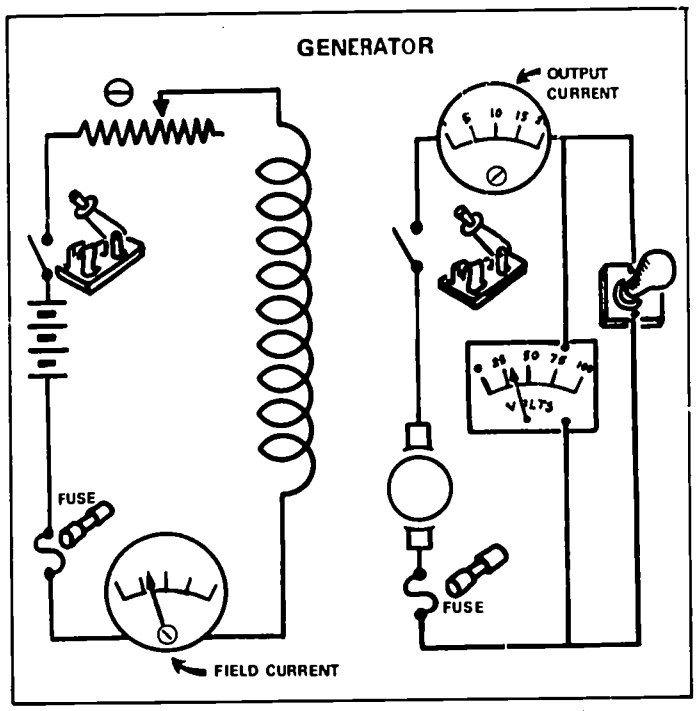
depends on whether the learning content is new to the trainees or a review of information previously discussed. It also depends on the number of trainees in the class and the location of the learning activity. Let's say the meeting is in a regular classroom with a group of 20 trainees who were not able to describe this operation after it was presented by a film in class. With a large model of a slide rule and 20 slide rules, the model can be displayed in front of the classroom to demonstrate the process, and individual slide rules can be used for trainee practice during the demonstration.

Mock-ups

The term "mock-up" suggests an imitation of a real thing, which in fact it is; but the imitation does not necessarily involve similarity of appearance as is true of a model.

The difference between models and mock-ups is that a model is essentially a recognizable imitation of the original—whether workable or not—but a mock-up rearranges the essential elements of the original and concentrates on certain common elements. In designing or fabricating a mock-up, one should be concerned with stressing certain elements and abridging others in order to teach what is regarded as chiefly important. Consider the problems an instructor may encounter in his teaching. To begin with, he wants his learners to behave in an environment which offers as many of the physical characteristics of the real situation as possible. He wants a steering wheel which is full-size; he wants pedals and levers which are realistic in terms of their spatial relationships to each other. How can he provide these factors in the learner's environment? He might use a real car, but he rejects the idea for budgetary reasons. He might use a small model of a car, but this would not provide the full scale spatial relationships which he considers essential. Pictures, even three-dimensional ones, would not provide the opportunity for manipulation which is such an important aspect of the instruction which he wants to provide. The solution is simple: the instructional medium which has the capacity for providing the desired environment is a mock-up. Mock-ups, used in vocational, technical and military service schools, are exteremely valuable for saving time and clarifying difficult to understand points.

Figure 9
MOCK-UP



FOLLOW-UP EVALUATION

The effectiveness of media used to support a learning unit will depend on many factors. For this reason, the total effect that visual materials have on a learning situation is difficult to predict, or to assess. Therefore, it can be done by assessing the effect of the total instructional package—not just visuals alone.

Although the total effect of visual materials cannot be assessed separately, we can check their value, to some degree, as a part of the total feedback system. The Department of Instructional Technology, University of Southern California has developed and used successfully an "Evaluation Form for Instructional Materials" to assess visuals used in an instructional package. This form (Figure 10) lists key phrases that can guide the evaluator in giving a value to the visuals used in the total instructional package.

As mentioned earlier, a dry-run using the visual materials will permit the instructor and other staff members to estimate the effective-

ness of visual materials in context prior to the actual presentation.

The process of evaluating visual materials is a continuing function. At every point in the teaching process, we use information to evaluate. We decide whether the methods, the media, the grouping procedures, space utilization, and time allocation are contributing to the prespecified desired outcomes. If not, we try other methods, select different media, group trainees in new patterns or use space and time in another way.

Figure 10

EVALUATION FORM FOR INSTRUCTIONAL MATERIALS [14]

Evaluator .....

Date .....

Title ..... Medium .....

Length ..... Producer .....

Released by ..... Release year .....

Purchase Cost ..... Accompanying materials:

Circle one: Color Black & White Color & Black & White

Content Information: Rate each from 1 (bad) to 5 (excellent)

1. bad (no)
2. poor
3. average
4. good
5. excellent (yes)

Primary Importance:

1. Clarity of objectives.
2. Adequate repetition of important points.
3. Clarity of organization.
4. Appropriate for course.
5. Enough emphasis placed on important points.
6. Will it hold student's attention?
7. Clarity of detail presentation.

Secondary Importance:

1. Treatment appropriate for subject matter.
2. Rate of introduction of concepts.
3. Relates to previous knowledge.
4. Integration of verbal and pictorial content.
5. Number of concepts.

For Subject Matter Specialists:

1. Technically correct.
2. Up to date.
3. Too specific.
4. Too general.
5. Shows common errors and how to avoid them.
6. Could be treated better and/or less expensively by another medium.

Comments:

FOOTNOTES

[1] U. S. Congress, House, Committee on Education and Labor, *Report to the President and the Congress by the Commission on Instructional Technology: To Improve Learning*, (Washington, D. C.: Government Printing Office, 1970), p. 79.

[2] U. S. Civil Service Commission, Bureau of Training, Training Evaluation: A Guide to its Planning, Development, and Use in Agency Training Courses: No. IV (Washington, D. C.: Government Printing Office, 1971), p. 7.

[3] *Ibid.*

[4] *Ibid.*

[5] U. S. Army Engineer School, "Principles and Types of Aids" in *Lessons Reference File*, IG.400-1 (Fort Belvoir, Va., 1967), pp. 12-14.

[6] U. S. Army Engineer School, IG.400-1, op. cit., pp. 8-9.

[7] James W. Brown, Richard B. Lewis, and Fred F. Harcleroad, *AV Instruction: Media and Methods* (New York: McGraw-Hill, 1969), pp. 239-241.

[8] *Ibid.*, pp. 232-235.

[9] Robert M. Gagne', *The Conditions of Learning* (New York: Holt, Rinehart and Winston, Inc., 1965), p. 280.

[10] Abram W. Vander Meer, "The Impact of New Materials and Media on Curricular Design," *Educational Technology*, Vol. X, No. 4 (April 1970), p. 55.

[11] *Idem.*

[12] *Ibid.*, p. 56.

[13] A. J. Foy Cross and Irene F. Cypher, *Audio Visual Education* (New York: Thomas Y. Croswell Co., 1961), p. 174.

[14] John Bruha, "Evaluation: Another Look," *Audiovisual Instruction*, Vol. XII, No. 4 (April 1967), p. 364.

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